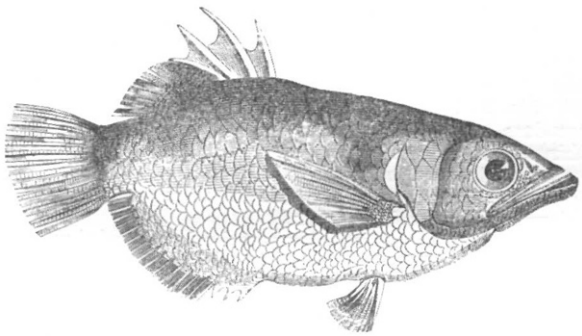
"12. *C. toli.* The subject of a very extensive fishery on the coast of Sumatra for the sake of its roes, which are salted and exported to China, the dried fish themselves being sent into the interior of the island. The fish is called 'Trubu' by the Malays, is about eighteen inches long, and it is said that between fourteen and fifteen millions are caught annually.

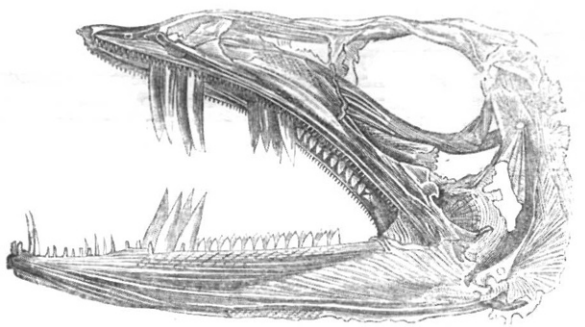
"13. *C. scombrina.* The 'oil sardine' of the eastern coast of the Indian Peninsula."[1]

These quotations will show the value and importance as well as the interest of the systematic and descriptive part of this volume, not a page of which is without some



Toxotes jaculator.

lines of most instructive reading, in many cases sufficiently so as to tempt one to turn "Ichthyologist" on the spot. We strongly recommend the reader to turn at once to the pages on the Salmonidæ. This portion too is illustrated with many excellent figures, two of which, through the courtesy of the publishers, we are permitted to reproduce —the first is of a fish belonging to the genus Toxotes. Two species of this genus are known from the East Indies, one of which (*T. jaculator*) is the more common, and it ranges to the north coast of Australia. It has received its name from its habit of squirting a drop of water at an insect which it perceives close to the surface in order to



Skull of *Plagyodus ferox.*

make it fall into it. The Malays, who call it "Ikan sumpit," keep it in a bowl in order to witness this singular habit, which it continues even in captivity.

The second woodcut represents the bones of the head of one of the largest and most formidable of the deep-sea fishes. Of the genus Plagyodus but one species is known (*P. ferox*). It has been found off Madeira and in the sea off Tasmania. Other species have been noticed from Cuba and from the North Pacific, but it is doubtful if they differ specifically from *P. ferox*. The fish grows to a length of six feet, and from the stomach of one specimen have been taken several eight-armed cuttle-fish, Crustacea, Ascidians, a young brama, twelve young boar fishes, a horse-mackerel, and one young of its own species. The stomach is coëcal, the commencement of the intestine has extremely thick walls, its inner surface being cellular, like the lung of a reptile, it has no pyloric appendage. All the bones are extremely thin, light, and flexible, containing very little earthy matter. Very singular is the development of a system of abdominal ribs symmetrically arranged on both sides and extending the whole length of the abdomen. Perfect specimens are rarely obtained on account of the want of coherence of the muscular and osseous parts, caused by the diminution of pressure when the fish reaches the surface of the water. The exact depth at which *Plagyodus ferox* lives is not known; probably it never rises above a depth of 300 fathoms; but woe betide any rash intruder that dares to descend into the realms of its abyss.

The volume closes with some directions for collecting and preserving fishes—when practicable fishes when dead should be set to swim in spirit. But we must not quote any more, so leave the curious reader to find out the details of how, having caught his fish, he can cook it so as to make it of value for some national museum.

[1] In this quotation the fin formulæ and references to works on the Herring, &c., are omitted.

SULPHURIC ACID AND ALKALI

A Theoretical and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali, with the Collateral Branches. By George Lunge, Ph.D., F.R.S.E., Professor of Technical Chemistry at the Federal Polytechnic School, Zurich (formerly manager of the Tyne Alkali Works, South Shields). Vol. III. (J. Van Voorst, 1880.)

THE publication of the third and concluding volume of Prof. Lunge's excellent work follows wonderfully soon on that of the first and second. This volume, which fully equals the other two in accuracy of description and clearness of style, is devoted to the subsidiary processes lying alongside of the main channel of Leblanc's great discovery. We first find a chapter on the ammoniacal soda process now rising, through Solvay's exertions, into well-merited and formidable competition with its older rival. The ash made by this theoretically beautifully simple and practically most original process is very pure, containing from 98 to 99 per cent. of Na_2CO_3, and free of course from the impurities common to Leblanc's ash of caustic soda and sulphide of sodium.

But this Solvay's ash is less dense than that made by the old plan, and both German and English manufacturers are now making a Leblanc ash of 98 per cent. free from sulphur and of a dense quality. The struggle, says Lunge, is not now one of purity, but merely of price, and so far Leblanc soda is holding its own. Here however the beneficial action of competition is seen: if Messrs. Brunner, Mond, and Co., of Northwich and Sandbach, were not turning out from 35 to 40 tons of Solvay ash *per diem*, I cannot help thinking that the Leblanc soda-makers might have felt inclined to rest content with their previous performances. There is of course no chance of this new process turning out the old-fashioned plan until the chlorine of the common salt can by this new method

be made available as a marketable article. At present it runs away as calcium chloride ; but if Weldon's process for regenerating the chlorine were to prove as successful as his well-known plan (of world-wide application) for obtaining it from the ordinary chlorine-still liquor has proved (and this so far has not come to pass), it is pretty clear that all the old alkali works would have to be closed. Next come the chapters on Bleaching Powder and Chlorate of Potash. Here we find thirty-four pages of a practical treatise devoted to the theoretical consideration of the composition of bleaching powder, and even graphical formulæ may be detected on some of these pages, to say nothing of chemical equations of some complexity, involving the discussion of one of the most intricate of chemical problems. This is a pretty dish to set before our "typical practical man," who only knows the substance he makes under the names of "B.P." or "Chemic," and would be puzzled to say of what it consisted. It is however a species of nourishment which it will do him good inwardly to digest, for if he turns away from it in disgust and dismay, so much the worse for him and his manufacture. "The rule of thumb," as Mr. Mundella truly said at Leeds the other day, "is now over; we stand at its grave." Our manufacturers must all be thoroughly trained in the scientific principles which underlie their trades. Noble and great things have been done by Englishmen in the perfection and development of chemical industry, and still greater things remain for them to do; but whilst taking only proper credit for what England has done and is doing, let us not forget that the general scientific education of our manufacturers and managers is far below that of their Continental competitors. It is no doubt quite true that no German alkali work could exist were it not for their import duty on English soda ; for even with all their care and scientific knowledge, the Germans are unable to compete on equal terms with us, thanks rather to the circumstances of our environment than to any special merits of our own.

But this artificial and economically unsound condition of Continental manufacture ought rather to urge us so to complete our system that we not only shall have the advantages which geographical position and geological good fortune places at our disposal, but also that thorough scientific training and the knowledge of what is being done elsewhere, without which all natural advantages become comparatively valueless. In this way and in this way only can we, as it seems to me, fight against the incubus of protective tariffs. On this necessity for our typical "practical man" to re-consider his position and to arm himself for the technical war with every appliance which science places at his disposal, Dr. Lunge speaks so forcibly and so well in the preface to his third volume that I take the liberty of giving his remarks *in extenso*.

I may however express my own doubts whether the British alkali-maker has, as Dr. Lunge maintains, in reality been distanced by any foreign manufacturer of alkali or sulphuric acid, except so far as regards the import of British goods into countries where inland production is artificially stimulated by protection. As regards other chemical industries, especially those such as the manufacture of colours, in which great delicacy and care in manipulation and an intimate knowledge of the highest developments of organic chemistry are essential, one must in sorrow confess that Dr. Lunge is perfectly right when he says that the English trade is rapidly passing into the hands of French and German houses.

"Other books aim at nothing but giving an accurate description of the present style of making sulphuric acid and alkali in England; and they leave the chemistry of the subject almost totally aside. My treatise differs from this in several respects. First it gives a detailed chemical description of the raw materials, intermediate and final products, of the modes of testing, and so forth, supplemented by numerous tables of solubilities, densities, &c. ; and it also enters very fully into the theory of all the processes concerned, accurately citing all papers on the subject, so that the reader can go to these for further elucidation. I am quite aware that a treatment of this kind will appear lengthy and superfluous to some readers who look into this book merely for 'practical' hints. In this respect they will not, I trust, be disappointed either, but I make bold to say that they would do very well not to despise the scientific part, the purely chemical detail, of this work.

"After all, our subject belongs to the domain of *chemistry*, and the times are far behind us when, in the manufacture of chemical products, the practical man with his rule of thumb could look down upon the chemist in the laboratory—who in the former's idea was at best only good for testing the materials, but whose interference with the works would invariably cause mischief. That this was true to some extent, and still is so, where the chemist attempts to transfer his ideas into practice in a crude state without sufficient practical experience, nobody can possibly deny. But does the 'practical man' on his part make no mistakes?

"Have not untold sums been wasted in futile 'inventions' and 'improvements' merely because 'practical' inventors lacked a scientific knowledge of their subject? Probably very much larger sums have been lost in this way than by the deficiency in practical experience of 'theoretical' inventors, for the simple reason that the latter class of inventors generally have not so much means at command as the former. It is a mere truism that theory and practice should always go hand in hand; but it must nevertheless be inculcated over and over again, as would appear from the fact that several costly books on perhaps the most important branch of chemical industry have just been published with next to no chemistry in them. And to what consequences does this neglect of a scientific treatment of practical subjects lead? The author may be pardoned for illustrating this from his personal experience. A little more than sixteen years ago he left his native country for Great Britain, and he might justly hope to learn a great deal and find much more scope for himself in that country which he is proud to have made his second home. More particularly the manufacture of sulphuric acid, soda-ash, and bleaching-powder was at that time quite insignificant in Germany, and not very considerable in France as compared with Great Britain, nor could the technical appliances, the yields, or even the purity of the products in the two former countries vie with those of the latter. How different matters are now is a matter of notoriety. The manufacture of chemicals has made enormous strides forward, both in quantity and quality, in France, and even more so in Germany. Many of the chemicals of these countries outstrip those of English works in purity; and their plant and their processes are frequently superior to those used in the majority of English works. Everybody knows how this has come about. The foreign chemists and manufacturers have looked all round, not merely in their own countries, but wherever they could find improved methods and apparatus, and upon the practical knowledge thus gained

they have brought to bear the scientific training they had received at their universities and polytechnic schools. Thus they have already, in many fields formerly remunerative to British manufacturers, distanced the latter, immensely aided though these be by their long occupation of the ground and by permanent natural advantages, such as cheapness of coal and of freight, superior command of capital, &c., and this is likely to go on to an increasing extent if many British chemical manufacturers decline to profit from a scientific study of their respective branches. This is all the less excusable, as England from of old has been a stronghold of scientific chemistry, and can hold its own against the whole world in that respect."

To these words I will only add that one of the best possible signs of advancement in the study of science so necessary for the permanent well-being of our manufactures would be to find well-thumbed copies of Dr. Lunge's three volumes not only on the alkali-maker's shelves, but in the house of every manager, and on the table of every free library in the manufacturing districts.

H. E. ROSCOE

OUR BOOK SHELF

Aide-Mémoire du Voyageur. Par D. Kaltbrunner. (Zurich: Wurster et Cie., 1881.)

THIS is a sort of supplement to the "Manuel du Voyageur" by the same author, noticed in these pages at the time of its appearance. The present volume may be described as a collection of constants in all departments of science likely to be of service to the scientific traveller, and indeed to students of many kinds. It contains a series of sections in geography (mathematical, physical, and political), geology, biology, and anthropology. To each section is prefixed a list of works to be consulted on the particular subject, numerous plates and maps, an index, and a table of authors whose works are cited. The whole work seems to us well put together, the information really useful, and, so far as we have tested, trustworthy, though the lists of works are not always so complete as they might be; this can be easily amended in subsequent editions. To all interested in geography in its widest sense, the work must prove of real service.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Geological Climates

I SHOULD not say more on this subject, but that the last paragraph of Mr. Starkie Gardner's letter seems to imply that I have adopted some of his views without acknowledgment. Now I certainly read his article in NATURE of December 12, 1878, with much interest and profit; but, as regards the special question of the cause of the mild climates of Eocene and Miocene times, I entirely disagreed with his views, as is sufficiently shown by my recent letter in NATURE. I quite admit that the closing up of the North Atlantic between Europe and North America *might* have considerably raised the temperature of Britain, but it would just as certainly have rendered the Arctic regions even colder than they are now, by shutting out the Gulf Stream, whereas all the evidence points to *continuous* mild Arctic climates through Cretaceous, Eocene, and Miocene times. Again, though I admit that there has probably, on more than one occasion during the Tertiary period, been a land connection between North-West Europe and North-East America, yet the peculiar distribution of the Tertiary mammalia of Europe and North America indicates that such connection was exceptional, and only endured for very short periods, the rule being a separation like that which now exists. I could therefore only have quoted Mr. Gardner's view to disagree with it; and I did not think it advisable to encumber the exposition of my own theory with more references of this kind than were absolutely necessary. I may add, that the extension of the Miocene Arctic flora to Grinnell Land since Mr. Gardner's article appeared, renders his views still more untenable. Of course I here refer to my chapter on "Mild Arctic Climates" in "Island Life." In my letter to NATURE I confined myself strictly to the point raised by Prof. Haughton, which I did not consider had been adequately met by Mr. Gardner's hypothesis.

ALFRED R. WALLACE

Is your correspondent, Mr. Ingram of Belvoir Castle, quite certain that he has not confused the *Araucaria Cunninghami* of Queensland with *Cunninghamia lanceolata* of China? The names are misleading.

H. KING

Chithurst, Petersfield

Temperature of the Breath

FROM time to time during the past few months letters on "the temperature of the breath" have appeared in NATURE, and some conjectures have been advanced regarding the cause of the high temperatures produced by breathing on thermometers enveloped in silk or other materials.

One of the correspondents supposes that the high temperature thus produced indicates a cooling action of the breath. The refrigerating agency of respiration by the heating of respired air and by evaporation from the lungs is sufficiently well known, and has been calculated by Helmholtz; but it is scarcely logical to ascribe to the breath a temperature so obviously produced by the intervention of another agent, and this hypothesis would involve the rejection of all observations hitherto made by physiologists on the temperature of the breath and of the blood.

A few lines which appeared in NATURE of October 7 indicated what appeared to me to be the simple and philosophical explanation (*i.e.* hygroscopic condensation) of the phenomenon under discussion. The higher temperatures produced in dry than in wet weather, and by some materials than by others, distinctly point to the hygroscopic state and nature of the material as the modifying influences.

The question is entirely physical, and not physiological. Wrapping the thermometer in a new factor in taking the temperature of the breath, and is, *primâ facie*, the cause of the high temperature. Some further experiments which I have just completed place the matter beyond all doubt. Not to occupy your space with unnecessary details, I give only an outline of them:—

1. A current of air directed upon the bulb of a naked thermometer caused no appreciable rise; neither did the mercury rise when the bulb was enveloped in silk; but when it was enveloped in *dried* silk it rose several degrees. (The silk was dried by heat, and allowed to cool in a stoppered bottle.)

2. Three thermometers—(1) bulb naked, (2) bulb wrapped in silk, (3) bulb wrapped in *dried* silk—placed in a current of *hot damp* air for some minutes, marked respectively 116°, 120°, and 123° F.

3. Two thermometers, one naked, the other wrapped in silk, were placed in a flask, with their stems passed through the cork. The flask was then immersed in hot water (about 150° F.). The naked thermometer rose rapidly, the covered one very slowly. After twenty minutes the temperature of the water was 120°, and the naked thermometer marked 112°, while the covered one registered only 108°.

4. Two thermometers, one naked, the second wrapped in dried silk, were fixed in a flask as for last experiment, but a little water was placed in the flask, which was then plunged into hot water as before. The naked thermometer rose rapidly at first, but it was soon outstripped by the covered one. The following was the result after some minutes:—Water, 128°; naked thermometer, 118°; covered thermometer, 136°.

5. Two thermometers, one naked, the second enveloped in dried silk, were passed through a cover fitting a glass vessel which was carefully dried and heated, and the cover was cemented on to prevent the passage of moisture from the air. After an hour the naked thermometer had cooled to 81° (temperature of air), and the covered one to 83°. They were then changed to a similar vessel containing a little water; the